WEST

Help | Logout | Interrupt

Main Menu | Search Form | Posting Counts | Show S Numbers | Edit S Numbers | Preferences | Cases

Search Results -

Term	Documents
AMPLIFIER.USPT.	242260
AMPLIFIERS.USPT.	104632
PRE-AMPLEFIER	0
PRE-AMPLEFIERS	0
PREAMPLIFIER.USPT.	17155
PREAMPLIFIERS.USPT.	4178
(2 AND (PRE-AMPLEFIER OR PREAMPLIFIER OR AMPLIFIER)).USPT.	75
(L2 AND (AMPLIFIER OR PRE-AMPLEFIER OR PREAMPLIFIER)).USPT.	75

Database:
- US Patents Full-Text Database
- US Pre-Grant Publication Full-Text Database
- JPO Abstracts Database
- EPO Abstracts Database
- Derwent World Patents Index
- IBM Technical Disclosure Bulletins

Search: L3

Refine Search

Recall Text | Clear

Search History

DATE: Thursday, April 03, 2003 Printable Copy Create Case

Set Name side by side	**Query**	**Hit Count**	**Set Name** result set
	DB=USPT; PLUR=YES; OP=ADJ		
L3	L2 and (amplifier or pre-amplefier or preamplifier)	75	L3
L2	L1 and (coil adj array)	95	L2
L1	(magnetic adj resonance) and (((radio adj frequency) or rf) adj coil)	1985	L1

END OF SEARCH HISTORY

WEST

Help | Logout | Interrupt

Main Menu | Search Form | Posting Counts | Show S Numbers | Edit S Numbers | Preferences | Cases

Search Results -

Term	Documents
AMPLIFIER.USPT.	242260
AMPLIFIERS.USPT.	104632
PRE-AMPLEFIER	0
PRE-AMPLEFIERS	0
PREAMPLIFIER.USPT.	17155
PREAMPLIFIERS.USPT.	4178
(2 AND (PRE-AMPLEFIER OR PREAMPLIFIER OR AMPLIFIER)).USPT.	75
(L2 AND (AMPLIFIER OR PRE-AMPLEFIER OR PREAMPLIFIER)).USPT.	75

Database:
US Patents Full-Text Database
US Pre-Grant Publication Full-Text Database
JPO Abstracts Database
EPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search: L3

Refine Search

Recall Text | Clear

Search History

DATE: Thursday, April 03, 2003 Printable Copy Create Case

Set Name side by side	**Query**	**Hit Count**	**Set Name** result set
	DB=USPT; PLUR=YES; OP=ADJ		
L3	L2 and (amplifier or pre-amplefier or preamplifier)	75	L3
L2	L1 and (coil adj array)	95	L2
L1	(magnetic adj resonance) and (((radio adj frequency) or rf) adj coil)	1985	L1

END OF SEARCH HISTORY

WEST

Generate Collection

L3: Entry 14 of 75 File: USPT Jun 25, 2002

US-PAT-NO: 6411090
DOCUMENT-IDENTIFIER: US 6411090 B1

TITLE: Magnetic resonance imaging transmit coil

DATE-ISSUED: June 25, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Boskamp; Eddy B.	Menomonee Falls	WI		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
GE Medical Systems Global Technology Company, LLC	Waukesah	WI			02

APPL-NO: 09/ 681970 [PALM]
DATE FILED: July 2, 2001

INT-CL: [07] G01 V 3/00

US-CL-ISSUED: 324/318; 324/309, 324/322
US-CL-CURRENT: 324/318; 324/309, 324/322

FIELD-OF-SEARCH: 324/318, 324/309, 324/322, 324/307, 128/653

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4665368	May 1987	Sugiyama et al.	324/318
5144243	September 1992	Nabayashi et al.	324/318
5445153	August 1995	Sugie et al.	124/653.5
6150816	November 2000	Srinivasan	324/318
6169400	January 2001	Sakuma	324/318

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0 366 188	May 1990	EP	

ART-UNIT: 2862

PRIMARY-EXAMINER: Lefkowitz; Edward

ASSISTANT-EXAMINER: Shrivastav; Brij B.

ABSTRACT:

A magnetic resonance imaging (MRI) coil system is provided which comprises an RF coil element comprising a plurality of electrically conductive members spaced to form a generally tubular structure and defining an imaging volume. The coil element is adapted to receive a RF signal and apply a magnetic field to the imaging volume. A signal generator generates the RF signal, and a power splitter is adapted to distribute the RF signal across each of the plurality of electrically conductive members in signals of equal power. A phase shifter receives the split signals from the signal splitter and equally phase shifts each of the split RF signals across each of the plurality of electrically conductive members such that each conductor carries the signal at a different phase angle with respect to each other conductor. An amplifier is coupled to each of the conductors for independently controlling the current amplitude of the signal carried on the respective conductor.

16 Claims, 4 Drawing figures

WEST

Generate Collection | Print

L3: Entry 14 of 75 File: USPT Jun 25, 2002

DOCUMENT-IDENTIFIER: US 6411090 B1
TITLE: Magnetic resonance imaging transmit coil

Abstract Text (1):
A magnetic resonance imaging (MRI) coil system is provided which comprises an RF coil element comprising a plurality of electrically conductive members spaced to form a generally tubular structure and defining an imaging volume. The coil element is adapted to receive a RF signal and apply a magnetic field to the imaging volume. A signal generator generates the RF signal, and a power splitter is adapted to distribute the RF signal across each of the plurality of electrically conductive members in signals of equal power. A phase shifter receives the split signals from the signal splitter and equally phase shifts each of the split RF signals across each of the plurality of electrically conductive members such that each conductor carries the signal at a different phase angle with respect to each other conductor. An amplifier is coupled to each of the conductors for independently controlling the current amplitude of the signal carried on the respective conductor.

Brief Summary Text (2):
The present invention relates to the field of magnetic resonance imaging (MRI) systems and, more particularly, concerns radio frequency (RF) coils for use in such systems.

Brief Summary Text (3):
In MRI systems or nuclear magnetic resonance (NMR) systems, radio frequency signals are provided in the form of circularly polarized or rotating magnetic fields having an axis of rotation aligned with a main magnetic field. An RF field is then applied in the region being examined in a direction orthogonal to the static field direction, to excite magnetic resonance in the region, and resulting RF signals are detected and processed. Receiving coils intercept the radio frequency magnetic field generated by the subject under investigation in the presence of the main magnetic field in order to provide an image of the subject. Typically, such RF coils are either surface-type coils or volume-type coils, depending upon the particular application. Normally, separate RF coils are used for excitation and detection, but the same coil or array of coils may be used for both purposes.

Drawing Description Text (5):
FIG. 2 is a block diagram of a magnetic resonance imaging system according to one embodiment of the present invention;

Detailed Description Text (4):
Referring now to FIG. 2, there is shown a block diagram of an MRI system operable to perform a magnetic resonance imaging by using a radio frequency coil according to the present invention.

Detailed Description Text (6):
A transmission coil section T forming a cylindrical assembly is installed within the static magnetic field space between the gradient coil sections G. A body coil section B forming a cylindrical assembly is installed within the static magnetic field space within the transmission coil T. A central axis of the body coil section B is crossed at a right angle with a direction of the static magnetic field. Between the gradient coil sections G and the transmission coil T there is an RF shield S that shields the transmission coils from the gradient coils. Although separate RF coils are shown for excitation (transmission coil T) and detection (body coil B), the same coil or array of coils may be used for both purposes.

Detailed Description Text (8):

transmission coil section TR is connected to the transmission coil T. The transmission coil section TR applies a driving signal to the transmission coil T so as to generate a radio (RF) magnetic field, thereby a spin in the body of the inspected body O is excited. The transmission coil T and transmission coil section TR is one example of a preferred embodiment of the transmission coil of the present invention. Details of the transmission coil will be described below with reference to FIG. 3. A gradient driving section GR is connected to the gradient coil sections G. The gradient driving section GR applies a driving signal to the gradient coil sections G so as to generate a gradient magnetic field. To the body coil section B is connected a receiving section RV. To the receiving section RV is inputted a magnetic resonance receiving signal received by the body coil section B.

Detailed Description Text (12):
Referring now to FIG. 3 there is shown a schematic block diagram of one embodiment of the transmit coil T according to the present invention for use in the exemplary system of FIG. 2. In this example, the transmit coil comprises a sixteen leg or rung birdcage 30. Thus, between each ring 32, 34 of the birdcage 30 there extends sixteen legs 36. For simplicity, the birdcage 30 is shown in the planar configuration. Each leg 36 of the transmit coil 30 includes an amplifier 38 which is preferably a MOSFET amplifier. Preferably, each power amplifier 38 comprises a single power MOSFET or a push-pull configuration amplifier such as MRF154 available from Motorola Corporation, as well as the associated DC circuitry and matching circuitry. In this regard, careful attention should be given to the routing of the DC current so as not to impair the homogeneity of the DC magnetic field. Preferably, the matching circuitry is designed for maximum energy transfer between the power amp 38 and the coil rungs 36, as well as between the different components of the transmission section TR. In addition, a pickup loop can be integrated into each leg or rung 36 to monitor the current amplitude and phase, and the signal can be fed back to the amplifier to ensure stable levels of amplitude and phase. An example of such circuitry is discussed below with reference to FIG. 4.

Detailed Description Text (13):
The transmission section TR operates to control the excitation of the transmission coil 30. In this example, a preamplifier 40 amplifies the RF pulse from the waveform generator 42 to levels acceptable for the input of the power amplifiers 38 which are integrated into the transmit coil 30.

Detailed Description Text (14):
In the case of the sixteen-rod birdcage shown in FIG. 3, the amplified RF pulse is split by a sixteen-way power splitter 44 which divides the power into sixteen equal components. Any conventional power splitter design can be used for this task and the implementation thereof be readily apparent to one of skill in the art of RF electronics. The resulting sixteen power signals 45 are communicated to a sixteen-way phase shifter 46 to provide sixteen signals 47 having a sinusoidal amplitude distribution. Each of the signals 47 is then communicated to a corresponding gate of a power amplifier 38 associated with a birdcage rung 36. In this example, the phase shift between two neighboring power channels is 22.5.degree. C., which represents 360.degree. C. across channels 1 through 16. In the case of an eight conductor birdcage coil, the phase shift between two neighboring power channels is 45.degree. C., which represents 360.degree. C. across the eight conductors. Other well known components which comprise the birdcage such as capacitors, inductors, and matching circuits are not shown for the sake of simplicity.

Detailed Description Text (15):
FIG. 3 is one example of a preferred application according to the present invention. The illustrated embodiment, however, is intended to be exemplary and not limiting. Indeed, the integrated power amplifier configuration of the present invention is equally applicable to any type of known homogeneous transmit coils including TEM transmit coils and birdcage coils.

Detailed Description Text (16):
Referring now to FIG. 4 there is shown an exemplary embodiment of the circuitry connections for a power amplifier and associated rung of the birdcage coil of FIG. 3. In FIG. 4, the matching network 100 is configured to match the input impendence of the power amplifier 102 (power MOSFET) to the 50 ohm coaxial cable 104 from the phase shifter. Matching network 106 matches the output impendence of the power amplifier 102 to the impendence looking into the corresponding rung 108 of the birdcage coil. In this way, the energy transfer from the power amplifier 102 to the rung 108 is maximized. Couplers 110, 112 measure the input signal and output signal, respectively. Preferably, coupler 112 is in the form of a pick-up loop to measure the current amplitude in the

rung 108. The respective signals from the input coupler 110 and output coupler 112 are compared at summer 120 after amplification by amplifiers 122, 124. An error signal results if the input and output signals differ. The resulting error signal is integrated by integrator 126 and communicated to the voltage controlled attenuator 130 which regulates the input signal until the error is zero.

Detailed Description Text (19):
In the present invention, a distributed integrated power amplifier is proposed which enables the construction of transmit coils having improved field of view regulation and drop off outside the field of view.

Detailed Description Text (20):
In particular, the present invention provides a radio frequency (RF) coil apparatus for resonance imaging/analysis comprising a plurality of axial conductors spaced to form a generally tubular structure and define an imaging volume. Each of the axial conductors has a first end and a second end. A first ring conductor is coupled to the first ends and a second ring conductor is coupled to the second ends to form a birdcage coil. An independently controllable amplifier is coupled to each respective axial conductor for independently controlling a current amplitude of a signal carried on said respective conductor.

Detailed Description Text (21):
In another aspect of the invention, a magnetic resonance imaging (MRI) coil system is provided which comprises an RF coil element comprising a plurality of electrically conductive members spaced to form and generally tubular structure and defining an imaging volume. The coil element is adapted to receive a RF signal and apply a RF magnetic field to the imaging volume. A signal generator generates the RF signal, and a power splitter is adapted to distribute the RF signal across each of the plurality of electrically conductive members in signals of equal power. A phase shifter receives the split signals from the signal splitter and equally phase shifts each of the split RF signals across each of the plurality of electrically conductive members such that each conductor carries the signal at a different phase angle with respect to each other conductor. An amplifier is coupled to each of the conductors for independently controlling the current amplitude of the signal carried on said respective conductor.

Detailed Description Text (22):
An advantage of the present invention is that it enables higher order transmit coils and arrays which eliminate artifacts by not exciting the artifact regions. Another advantage is that the present invention provides precise current amplitude and phase control throughout the transmit coil, thereby ensuring optimal homogeneity of the RF magnetic field.

Detailed Description Text (23):
A further advantage of the present invention is that it eliminates power losses between the power amp and the RF coil, in contrast to typical MRI systems wherein between 1 and 2 dB of

CLAIMS:

1. A radio frequency (RF) coil apparatus for resonance imaging/analysis comprising:

a plurality of axial conductors spaced to form and generally tubular structure and define an imaging volume, each axial conductor having first and second ends;

a first ring conductor coupled to the first ends;

a second ring conductor coupled to the second ends; and

a plurality of amplifiers, each of said amplifiers coupled to a respective axial conductor for independently controlling a current amplitude of a signal carried on said respective conductor.

2. The RF coil of claim 1 wherein the plurality of axial conductors equals between eight and sixteen.

3. The RF coil of claim 1 wherein each amplifier comprises a power MOSFET amplifier.

4. A magnetic resonance imaging (MRI) coil system comprising:

an RF coil element comprising a plurality of electrically conductive members spaced to form and generally tubular structure and defining an imaging volume, said coil element being adapted to receive a RF signal and apply a magnetic field to said imaging volume;

a signal generator for generating said RF signal;

a power splitter adapted to distribute said RF signal across each of said plurality of electrically conductive members;

a phase shifter adapted to phase shift said RF signal across each of said plurality of electrically conductive members such that each conductor carries said signal at a different phase angle with respect to each other conductor; and

a plurality of amplifiers, each of said amplifiers coupled to a respective conductor for independently controlling a current amplitude of the signal carried on said respective conductor.

5. The MRI coil system of claim 4 further comprising a controller adapted to independently control each of said amplifiers.

6. The MRI coil system of claim 5 wherein the RF coil element comprises sixteen electrically conductive members.

9. The MRI coil system of claim 4 wherein the RF coil element comprises eight electrically conductive members.

12. A phased array coil apparatus for use in an nuclear magnetic resonance (NMR) system, the coil comprising a plurality of electrically conductive members spaced to form and generally tubular structure and defining an imaging volume, said coil element being adapted to apply a RF magnetic field to said imaging volume, wherein each of said electrically conductive members is adapted to receive a RF signal and each of said electrically conductive members is configured to independently control a current amplitude of said signal.

13. The phased array coil of said claim 12 wherein each electrically conductive member includes an amplifier for independently controlling a current amplitude of said signal.

14. The phased array coil of said claim 13 wherein each of said amplifiers is a power MOSFET amplifier.